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Assessing I.T. Performance: What the Experts Say

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Management in the 1990s
Sloan School of Management
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Management in the 1990s

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For a substantial number of companies competing in a wide range of industries today, information technology has become a critical business variable. Expectations for its strategic impact have heightened in many sectors, fueled largely by consultants, academics, and managers who have documented on a case by case basis the successful and failed attempts to couple I.T. investments more tightly to core business objectives. In spite of these efforts, however, some senior executives today remain skeptical about their ability to capture any strategic benefits from such investments.

During the past eighteen months, we have interviewed 71 chief executive officers in ten different industrial sectors to learn more about their beliefs and assumptions about information technology. (1) From these interviews, we have observed that top managers are concerned about two key dimensions of I.T. The first relates to their assumptions about payoff: the scope and magnitude of expected benefits from I.T. The second relates to their own personal calculations of the likelihood that their firms will realize some or all of these benefits. One unexpected finding from our interviews is that many of these CEOs, including those whom we identified as "utopians" because they are so positive on both dimensions, are less than completely satisfied with the methods used in their organizations for assessing I.T. performance. The CEO of one of the 20 high technology firms we interviewed asked us:

What benefits does I.T. provide to the organization?
Do people really need it as much as they say they do?
We are able to cost justify the equipment, but is it
really making our people more effective?

The chairman of a large insurance corporation confided:

It's hard to know what produces competitive

advantage. MIS? I don't know how to measure its impact.

And the CEO of a mid-sized company admitted:

There are a few specific cases where you can tell -- like with robots. You can see what they cost, measure their productivity, and calculate if they are providing advantage. But for the most part, computing is not that way. I.S.? I don't know how to measure its impact.

These top managers have three fundamental questions when it comes to assessing I.T. performance:

1. How well are we doing the things we are doing now?
2. Are we doing the right things?
3. Are we fit to compete in the future?

The Expert Panel

Concerns such as those expressed by these CEOs provided the impetus for us to interview thirteen experts in the management of information technology in order to elicit their views on how to evaluate I.T. performance. We chose professors who teach information technology courses at two leading academic institutions and asked them to recommend names of other experts for whose opinions they had high regard. From this list of 18 experts, in addition to the previously mentioned academics, we selected five consultants of information technology, three managers of information systems from different Fortune 50 corporations, and a researcher actively studying the impact of information technology

on organizational performance.

Our query to each expert was a simple one: if asked by a CEO to assess a firm's I.T. performance, how would you do it? What questions should be asked and what information would you need?

One General Conclusion

The panel study generated two kinds of information: an extensive set of indicators of effectiveness and seven distinct assessment methods. In summary, 66 different indicators of I.T. performance were discussed, which raises a question about whether managers should avoid relying on just one assessment method or technique and, instead, should employ several methods when evaluating their I.T. investments and plans. One expert was emphatic about this advice:

There is not now, nor will there ever be, a convergence of opinion among experts regarding how I.T effectiveness is to be assessed. There are no more clear indicators of effectiveness than there are [of] goodness or badness of companies. In different environments, different metrics give people comfort. I wouldn't expect people to come up with a single metric of effectiveness.

(Professor)

Based on the results of this panel study, it is reasonable to conclude that a single index of I.T. effectiveness that has been widely adopted does not exist. One explanation for why so many different indicators of effectiveness are used is that the management of information technology is in a state of transition and, consequently, the managerial control systems that help executives keep score in this area and determine how

fit their company is for action also are in a state of evolution.

Three of the methods discussed by the experts are familiar and established approaches and primarily reflect what has been the dominant managerial vision of I.T. -- the automate perspective.

However, we also discuss four other assessment methods that at present seem underdeveloped because they reflect a new and emerging view of I.T., one that involves the applications of I.T. to new domains of work and tasks. Panel members expressed agreement about the need for new forms of control. Several expressed deep concerns about the way that many firms use traditional cost/benefit analyses:

Everybody does cost/benefit analysis on projects. Most of them are fictional. The saddest part is that it is not just the benefits that are fictional, but the costs as well. They don't begin to assess what the real costs of the systems are. You do cost/benefit analysis to get money.

We have trouble convincing ourselves of value in business terms. We cost justify new systems on the basis of lies, and having justified [them] on the basis of lies and overstatement, we then don't measure the true business value.

(Professor)

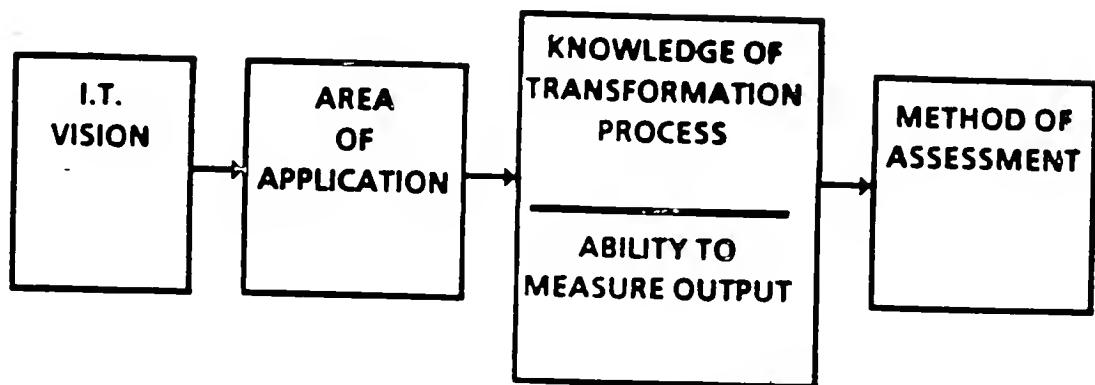
Experts were in general agreement that professionals do a good job of assessing performance for existing applications that cover current business processes, but are not particularly good at assessing capabilities for transforming current business processes into those which will position a firm for future competitive action.

Developing Assessment Concepts

The purpose of this paper is to provide a conceptual framework determining what are appropriate types of control for different executive visions or expectations of I.T. performance. The framework is an outgrowth of these expert views and is grounded in the experience of this particular set of people.

The four key elements of the framework are displayed below.

Figure 1. DETERMINANTS OF TYPES OF I.T. CONTROL



We discuss here seven different assessment methods recommended by this expert panel and analyze the usefulness of each for assessing performance for three distinctly different but broadly understood visions of I.T. capability. We refer to these as a vision to automate, a vision to informate (2) and a vision to transform the organization. (3) The vision to automate is the established vision; visions to informate and transform are emerging and, in most organizations today, are represented more as

expectation than as reality. We have taken this approach because we suspect that the sense of frustration and dissatisfaction that many executives experience when assessing I.T. performance results from employing justification and evaluation methods which are appropriate for the automating vision, but which do not really apply to monitoring progress on the other two visions. The unfortunate consequence of such a situation is that decisionmakers become trapped by a planning and control system that utilizes measures with little validity for assessing progress toward informating or transforming organizations.

The vision to automate involves the application of computers, communications and software to existing tasks and processes. It presumes detailed knowledge of the transformation process, because a vision to automate involves substituting the computer program for an already routine manual process. This vision becomes real when applications are developed for uniform transactions and standardized, structured workflows. With goals of improving efficiency and productivity, of standardizing operations, and of modernization, this vision, for the last 25 years, has provided the primary justification for managers to invest billions of dollars in computers, software, and telecommunications equipment. Guided by this automating perspective of I.T.'s value, corporate managers justify investments based on expectations of reducing errors in the workflow, decreasing labor costs, and increasing productivity.

A vision to informate places a unique emphasis on expanding the intellectual content of work and on distributing knowledge about administrative and production processes at all levels of the

organization. For example, scanner devices in supermarkets automate the checkout process while simultaneously generating data that can be used for inventory control, scheduling of deliveries and market analysis. (4) Executive aspirations are to generate new streams of information and expand analytical capabilities, to emphasize more comprehensive jobs, and to change authority relationships between managers and employees.

Only recently has the vision to transform the organization around the unique strengths and characteristics of I.T. gained acceptance and understanding. This vision incorporates a significant element of planned change that ordinarily is not found in organizations that are automating. This view defines information technology as an instrument for changing the factors of competition, and it targets flexibility and change as essential elements of all business and functional action programs. Such a vision is derived from an assumption that discontinuities in market equilibrium will provide strategic opportunities, and that only by optimal utilization of I.T. will these opportunities be realized. One expert on the panel used investment banking to illustrate the need for such a vision in some businesses today:

No industry has moved more sharply or more completely from I.T. being just a support to the business to it being a critical factor of competition. In 1980, computer operations in investment banking firms were hidden down in the backwaters of the companies -- supremely irrelevant, vastly overpaid, low level kinds of people. In 1987, there they are, right out on the sharp tough point in terms of managing the process, the cultural change and shift in perspective. And it's been tough. The problem that has consumed them, unhappily, is managing the cultural transformation from the supremely irrelevant to the extremely relevant.

(Professor)

Managers have had far more experience in implementing visions to automate. Visions to transform and informate presume an acceptance of change without knowledge of what the new form of organization and competition will be, making it particularly difficult to assess performance.

We define effectiveness as the ability to bring about results; to show how performance is related to a set of goals or standards. Defined as such, any assessment process should focus on the attainment of goals and, depending on the outcomes, trigger responses which reflect learning and adaptation.

An index of I.T. effectiveness, then, requires two preference orderings: 1) someone must choose and weigh the goals or expectations to be evaluated and; 2) someone must designate what the standards or measures are for determining the extent to which these expectations have been achieved. One major dilemma, then, that has to be resolved in any assessment is to decide whose preferences or goals should form the basis of the assessment. There may be significant differences in the goals among corporate, business and functional managers, or goals may not be clearly stated, revealing a weak or even conflicting preferential ordering.

A good assessment method should also take into account the constraints which limit performance. Lack of resources, the stage of organizational development, and a range of environmental factors may explain poor performance; management's explicit goals for I.T. may not be realistic in context of such constraints.

The expert interviews revealed two basic types of variables used in assessment: output variables, such as sales, profit, growth, market share, MIPS per transaction, and hardware cost performance; and behavioral variables, such as actions, conduct, how tasks are performed, managers' abilities to influence and motivate, attitudes, and knowledge. This raises an important question. Under what conditions is one type of control variable feasible or preferable over the other? How should managers decide which control variable to use?

To answer this question, we build on a body of research (5) that identifies the conditions for determining what are appropriate control systems. One determinant is the knowledge of the transformation process; the extent to which rules of behavior and process can be specified. Or, stated differently, this dimension is an estimation of the extent to which we can program a series of tasks or a process. The second condition is the extent to which we have reliable measures of output or ambiguous standards of performance. Using extreme values for these two dimensions, we see from Figure 2 that four assessment choices are possible:

Figure 2. DETERMINANTS OF TYPE OF CONTROL
KNOWLEDGE OF TRANSFORMATION

		PROCESS	
		HIGH	LOW
MEASURABILITY OF OUTPUT	HIGH	EFFICIENCY TEST <hr/> OUTPUT OR BEHAVIORAL MEASURES <hr/> I	INSTRUMENTAL TEST <hr/> OUTPUT MEASURES <hr/> II
	MEDIUM	SOCIAL TEST <hr/> BEHAVIORAL MEASURES	SOCIAL TEST <hr/> RITUAL AND CEREMONY
	LOW		

One assumption of organizational control is that it is feasible to measure desired performance with reasonable accuracy. Such an assumption is satisfied by the existence of an efficiency test. In situations where the task environment is stable and we have perfect knowledge of tasks and rules of behavior, as well as reliable and precise standards of output, it is possible to determine whether a result has been produced with least cost: or, given a fixed amount of resource, whether the greatest result has been achieved. The results of an efficiency test are indisputable. Cost, quantity, and quality are the key variables of such tests. An example might be the number of lines of code produced by a programmer, the number of MIPS per transaction, or the number of checks processed during a given period of time.

But efficiency tests do not answer the institutional question of importance to executives at the top of organizations: what has the investment in I.T. or the function contributed to the organization's overall performance? For this, managers will use an instrumental test which answers whether a desired state of affairs has been achieved, and whether they will use simple, quantifiable measures. For situations like this, in which the task environment is unstable, and knowledge about the transformation process imperfect, efficiency tests are not available.

The problem for managers under these conditions is that exogenous variables are affecting technical results, or are operating in unpredictable ways, leaving them without perfect knowledge of how the tasks are or should be organized. Under such conditions, managers will rely on subjective, but measurable, output variables. An example might be the introduction of workstations to sales representatives who work

independently and whose work processes are unstructured and highly variable. In such cases, I.T. performance will be measured using an output variable, such as individual sales revenue. Another example is those situations in which top executives who have very incomplete knowledge of how the I.T. resource is being applied or delivered in behavioral terms, rely on return on investment as a measure of performance.

When the task environment is stable and knowledge of the transformation process and rules of behavior are perfect, but output measures cannot be expressed in quantitative terms, managers rely on social tests of performance, usually measured as the level of confidence expressed by the units which rely on the unit being assessed. In other words, what is being assessed is the extent to which actual behavior and process conform to what managers in these units believe should be done. For example, imagine that the marketing department of a large company relies on a central I.S. department for its applications development support. It is the marketing users who have the complete knowledge of their work process and therefore are most capable of assessing the value or performance of the services provided by the I.S. unit. Here it would be problematical to identify reliable output measures for assessing improved customer relationships or more sophisticated marketing knowledge (an informate benefit), and so managers rely on statements of confidence made by users.

In dynamic task environments, when knowledge of the transformation process is imperfect and output measurability low, managers will rely on two more types of social tests: one that involves comparison with comparable organizations, the other a test of ritual and ceremony which

presumes that an underlying set of values, attitudes and motivations on the part of key selected individuals will lead to success. For situations in which uncertainty about the task environment is very high, and performance measurability extremely low -- as when executives ask themselves, "Are we fit to compete in the future?" -- managers tend to rely on outside experts to judge their I.T. performance, or to recruit individuals with the professional values they believe will assure their ability to compete in the future. One example might be those firms in which a distinctly different type of manager than the traditionally trained systems manager has been put in charge of the I.T. function. By appointing a marketer or a business manager to head this function, a message is being communicated that past performance will not necessarily assure future success and that changes will have to be made.

With this conceptual framework, we now are able to do several things. First, we can distinguish different assessment methods based on their reliance on behavioral or output measures. Secondly, we can determine the appropriateness of specific assessment methods for different visions and applications of I.T. Third, we can determine whether a firm is utilizing controls systems that are consistent with executives' expectations for I.T.

In order to do this, each of the thirteen expert interviews was analyzed in several ways. Each interviewed for all indicators, yielding a total of 95 indicators. Duplicate variables were removed from the summary list, leaving 66 indicators, each of which then was coded as to its type -- output or behavior. The original interviews were analyzed again, this time to document any self-contained methods. Seven different methods

emerged from this analysis, and each indicator was assigned to one of these methods. Figure 3 lists these. It should be noted that for many of the indicators from the list of 66, measures were not specified; and so the question of whether operational procedures exist for all of these cannot be answered by the data presented here.

In the following sections of the paper, we describe each of the seven methods and analyze their usefulness for different contingencies, building our analysis upon the control framework. The labels used to describe these methods are my own. While no claim can be made that these seven methods of assessment exhaust all the possible approaches which firms employ, they do incorporate all the key variables recommended by this particular panel of experts who jointly encompass a broad range of corporate experience and practice.

Figure 3. SEVEN I.T. ASSESSMENT METHODS

Productivity Assessment

User Utility Assessment

Value Chain Assessment

Competitive Performance Assessment

Business Alignment Assessment

Investment Targeting Assessment

Management Vision Assessment

In the last section of the paper, conclusions are made regarding the appropriateness of these methods in context of the three managerial visions of information technology.

Assessing Productivity

The first approach focuses on determining the efficiency with which I.T. resources are expended. There is some divergence in experts' opinions regarding professional ability to evaluate I.T. productivity with any reliability and precision; but, if such measures exist and are used, this type of assessment should provide managers with enough information to answer the question "Are we doing the things we are doing well?" The measures predominantly used in assessing I.T. productivity include assessments of the volume of work or number of transactions processed; e.g. code, loans, checks, telephone calls, claims, etc. Systems measures that were mentioned include on-line systems performance, systems development productivity -- or number of programs per programmer -- hardware costs versus performance, and line of code per programmer.

Cost, quantity, and quality are key variables in such assessments, and what determines the appropriateness of using this method are whether: 1) perfect knowledge of the transformation process exists; and 2) precise, quantifiable output measures exist. Several experts identified "quality of data," "quality of the technology architecture," and "quality of the I.T. staff" as important indicators; but without precise empirical

measures for such "outputs," these can only be evaluated through instrumental or social tests.

Productivity is measured best when a business' or function's output is fairly homogeneous and does not reflect much change over time. Kilowatt hours of electricity and numbers of telephone calls are reliable measures of output; but for functions or businesses in which output is an intangible service of uncertain or variable quality, or where products change, productivity measurement is problematical. This explains why managers seek other means for assessing performance, such as user utility or value chain assessments.

Assessing User Utility

A second method often used is the assessment of user utility. Different approaches may be used for determining whether customers and clients for I.T. services are satisfied and perceive value in these services. One expert with extensive I.S. experience in the financial services sector commented:

One important measure is user feedback, or what I call the noise level. If the noise level is silent, you're doing a pretty good job. If you have a lot of negatives coming from users who are complaining about report deliveries that are late, uptime is downtime, nothing works right, costs too much -- that's when you have problems. Bad noise level is bad news. Most senior managers don't look at statistics. They look at how many people walk through the door complaining about computers, or how many letters are written by customers complaining about computers. It's so simple. Customers who get a statement that's wrong will write to the President.

(Manager)

Some I.T. departments conduct periodic surveys of their users to find out how they rate the utility of the applications, information, and other services they receive. This feedback is then incorporated into long range I.T. plans. One expert who has used such an approach explained, "The results of a biannual user survey are an integral part of our activities and plans. This is the proof of the pudding. How effectively are you servicing the internal customers?"

Expert opinion is divided, however, over the value of assessing user utility. One expert warned:

Is I.T. effectiveness a function of whether the users are happy or not? Many people think so. I say no. That is a dangerous assumption. Usage as a measure of effectiveness implies that the organizational process and structure are right.

(Consultant)

Another expert illustrated this problem with the following:

Take a contract in which I guarantee to deliver 95% of your critical reports on time, or that your system will be up 98% of the time. Whatever these measures are, they are agreed to in advance, documented and reported on regularly. The only problem with this is that no matter what the statistics say, the only thing users remember is when something doesn't work. Even though you reached the 98% uptime objective, the day it was down happened to be a very bad day, and he lost some customer business because of it.

(Manager)

The determinants for employing this type of control system are a perfect knowledge of the transformation process and low output measurability. In situations in which I.T. is applied to highly programmable tasks or

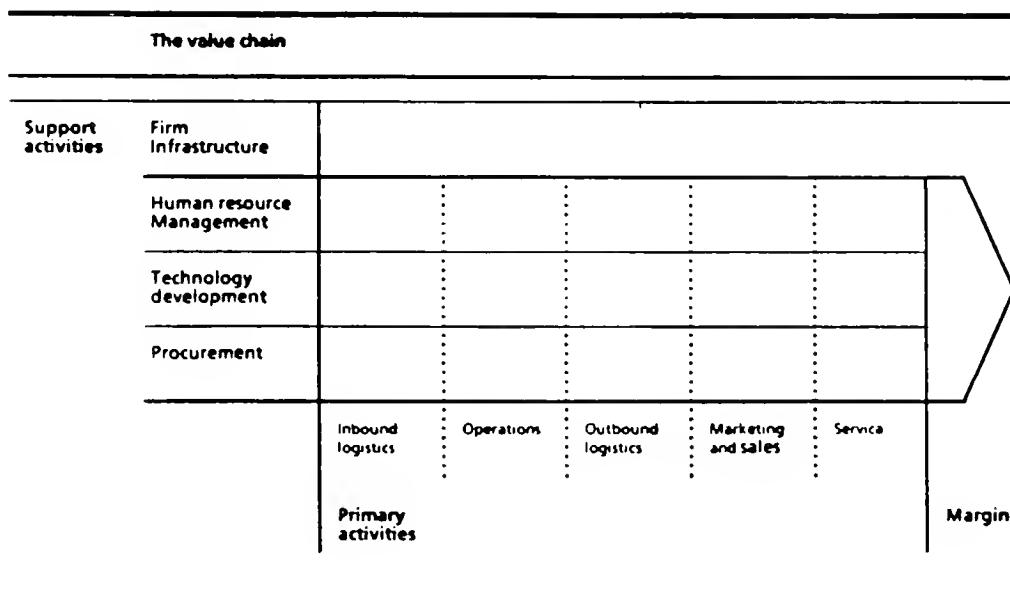
processes, using this form of a social test is appropriate.

Assessing Impact on the Value Chain

The third method for assessing I.T. performance is a value chain assessment. This approach attempts to quantify the impact of I.T. on functional goals by using performance standards established by functional managers and relies primarily on output variables.

A company's value chain is composed of nine generic technological and economic activities as described below.

Figure 4. The Value Chain (6)



Every activity in the value chain uses information, and I.T. may have an impact on the linkages between these value activities so as to produce competitive effects. Value chain assessment is appropriate for analyzing

the contribution or impact of I.T. on the attainment of specific functional goals which are measured with functional output variables.

For example, manufacturing might measure performance using such variables as "time to complete designs," or "overhead cost per procurement item"; or service might measure "reductions in costs of delivery," or "increasing lead time in financial transactions." If used in conjunction with other methods, such as user utility assessment or competitive performance assessment, decisionmakers may be in a better position to understand whether I.T. investments are tightly linked to functional needs and performance.

Similar to the value chain assessment is the critical success factors approach (7), by which managers evaluate the extent to which applications help them achieve their business goals, measured with output variables such as sales, revenue, growth, market share, profit, earnings, etc. This well known approach is a type of instrumental test and can be used at the corporate level with top executive, or at divisional or business unit levels, as dictated by the firm's organizational structure.

The important distinction between the value chain assessment and the user utility assessment is that the former relies on output variables, while the latter method is appropriate when knowledge of the transformation process is high and output measurability is low.

Assessing Competitive Performance

For many executives, their primary concern is whether they are investing in

the right projects and the right technology. One way of making such a determination is by comparing oneself to the competition. One expert, the vice president of information systems for a large, divisionalized manufacturer of industrial products, described this challenge:

The toughest question I face as an I.S. director with my top management is "Where do we stand competitively?" They continue to feel uncomfortable with our growth factor. We are the fastest growing function in terms of budget and people.

(Manager)

There are several variations on the theme of competitive performance assessment. One approach calls for an analysis of performance on specific infrastructure components -- e.g. database, telecommunications, hardware, applications, etc. -- as compared to that of companies reputed to be performance leaders for the same components, regardless of whether or not the companies compete in the same marketplace. The practice is described by an expert as it is used in his own company:

In some key areas, I want to see competitive benchmarks. It's comparing ourselves with the best we can find. Let's compare our data centers with the best. Let's compare our telecommunications network with the best. Let's compare the way we develop systems with the best we can find, regardless of the industry.

(Manager)

A second approach to competitive assessment is to compare an organization's performance on specific components against that of its immediate competitors. Such evaluations are driven by managerial goals to maintain an I.T. infrastructure that is more cost-effective than the competition. One major difficulty with competitive performance

assessments is that the measures used may not be reliable from one firm to another. Knowledge about the competitors' transformation process will be imperfect or incomplete, making it problematical to infer with any reliability how similar or comparable performance between firms really is. One expert shared his experience in trying to find useful standard measures for comparison:

We have tried to use quantitative measures in the past to compare ourselves to the competition -- percent of sales, profit, growth and all that -- which really was meaningless. Then we said, "Okay, what do we know about what our competition is doing?" And we went around and talked to our business managers and asked them for this information. It is available. We talked to 70 business units. Then we prepared a qualitative summary that explained where we stood against 12 competitors on telecommunications, marketing systems, component by component. We tried to do it in a way that would give top management a feel for where we are ahead, where we are comparable, and where we are behind. We also put the whole cake back together and subdivided it into major functions -- marketing, manufacturing, research and development -- and tried to figure out where we stand in basic computer technology. We used a number of consultants and tried to get as many inputs as we could. Our executives were more interested in the qualitative understanding than they had been in the quantitative approach.

(Manager)

Expert opinion is divided on whether spending levels are a meaningful output measure for competitive performance assessment. For example, in the banking industry, consulting firms widely publish for all major competitors the ratios of I.T. spending compared to non-interest expense. Among this panel of experts, there was at least one critic of using such a measure. He offered a cautious note:

I don't have a consensus from my clients or colleagues

on this, but, in my view, the average standards for determining what's worth doing in a business in terms of new investments are uniformly high. I believe everyone is over-invested because I believe there's a lot of junk out there.

(Consultant)

The next two methods are particularly useful for addressing the CEOs' question, "Are we doing the right things?", because each employs multiple assessment methods, as well as behavioral and output variables.

Assessing Business Alignment

The business alignment assessment examines the criticality of a firm's operating systems and its portfolio of applications to its business strategy. This is accompanied by asking the following set of questions:

1. What makes this business successful?
What does it need to do to compete?
(Similar to a critical success factors approach.)

2. What is being spent on I.T.? What is the strategic plan for I.T.? What is the age of the backlog of existing systems or the installed base? What has been the budget growth of I.T.?

3. How do I.T. expenditures and activities

map onto business activities?

4. Is the I.T. function integrated with the business units? Is the I.T. group responding to the business strategy and having an impact on the business units?
5. What are the implications of a disruption of I.T. service to the business units?
6. How does this alignment compare to the competition's? How critical is I.T. as a factor of competition? Has the company made a successful "competitive move" with I.T.?

Based on this systematic analysis, the firm then is typed according to the criticality of I.T. to the achievement of its business objectives. In the last step of this assessment, the firm's level of investment in I.T. is compared to its competition.

Although this method relies on some of the same indicators as the other methods discussed so far, it is grounded in some fundamentally different assumptions. First and foremost is that it takes into careful consideration not only the business goals but the constraints under which the firm operates. It assumes that the criticality and strategic importance of I.T. to a particular firm may change over time, due to

competitive actions and other changes in the external environment, or to internal factors, such as learning and adaptation. One expert who uses this method commented:

Contingent models are critical. You've got to figure out if it's a matter of life or death. You know, they nearly lost the bank at one of the leading investment banks this summer with a flood in the computer room. That kind of company thinks about it differently than, say, a utility where their big application is the weekly billing cycle and disruptions are irritating but not fatal. As you move from the utility to the investment bank, you use very different kinds of measures of effectiveness in assessing the operation.

(Professor)

This method incorporates: 1) an instrumental test which examines the contribution of I.T. to the business goals; 2) a social test of the extent to which business unit activities and I.T. activities are integrated; and 3) a test of social comparison of spending levels and criticality of individual systems with comparable organizations. By employing multiple measures and methods, managers may expand their ability for addressing the question "Are we doing the right things?"

Assessing Investment Targeting

The next method might be called Investment Targeting Assessment. One expert asserts:

I maintain that if your investment in I.T. is paying off, then it will show up somewhere in expenses and profits. If you cannot see it, then it does not exist. The argument is that your total investment in I.T. has to impact your cost structure, your revenue structure or the investment base.

(Consultant)

An underlying assumption of this method is that a firm's pattern of spending on I.T. is its de facto I.T. strategy. Undertaking such an assessment involves the following steps:

Step 1: Segmenting all users into functional areas and segmenting major categories of information technology.

Step 2: Comparing gross average spending levels for each segment to competitors' spending levels or to an industry standard.

Step 3: Identifying business objectives. (Again, a critical success factors approach may be used).

Step 4: Identifying organization pressure points. These are the critical variables that yield the highest leverage for achieving business objectives and can be described in terms of: 1. priority functions; 2. priority job families; 3. priority processes; and 4. priority products.

Step 5: Using the segmentation scheme developed in Step 1, identify the investments in I.T. that will have the greatest impact on the organization pressure points.

Step 6: Comparing pressure points and key investment targets to competitors.

Like the business alignment assessment, this approach incorporates multiple methods, although it does not include any behavioral variables of the kind used in the first type of social test. Included are a social test of spending comparability and a comprehensive instrumental test in which careful prioritization of functional outputs, human resource outputs, and product outputs are made. This method would be appropriate when knowledge of the transformation process is imperfect and output measurability high.

Assessing Management Vision

The seventh and last expert method employs measures of values, attitudes, and motivation as indicators of performance. The focus is on top management's understanding of the strategic value of information technology and their ability to provide leadership and direction for future action. This approach to evaluation might be called the management vision assessment. For many of the experts interviewed, this indicator of effectiveness is perceived as one of the most important. One expert explained the problem:

We are up against a barrier today. We brought the technology in stand-alone islands of automation and we cannot move forward because we cannot integrate the pieces. Secondly, we cannot change the attitudes and the underlying processes that really open the door to big payoffs.

(Consultant)

The expert emphasized the need for a new type of I.T. manager with values

distinctly different from those of previous eras. One expert seemed to speak for all the others in stating that the top I.T. manager must "speak the language of the general manager":

You need people who can communicate. People who feel comfortable talking to senior management. People who can translate problems into things that businessmen can understand. You don't want to tell them that your operating system went down last night because you had a SOC 7! What do they care? You've got to put it in terms that they can understand.

(Consultant)

Another stressed the importance of being able to think strategically:

CIOs [Chief Information Officers] have begun to play their most important role when they don't view their job as that of running daily operations, but as managing long range strategic thinking and architecture; seeing that you're supporting the corporation appropriately, that you're creating a techno-structure that is going to be responsive to future changes.

(Consultant)

Summarizing for the other experts, one of the consultants said:

One thing you look for is leadership skills in the head of the I.T. function; a business orientation and leadership skills and someone whose sense of values has shifted towards business values. That's critically important.

(Consultant)

The search and recruitment of managers with such values is one indicator of the fundamental transition which the professional management of I.T. has undergone over the last ten years. It is not only the I.T. professional whose values and attitudes have changed, however. Many of

these experts believe that, in the future, it will be those organizations whose executives have fundamentally different values and attitudes about I.T. from those whose visions are to automate who will be most competitive. One expert expressed it this way:

If an organization says that it's using technology strategically and I probe what that means in terms of organizational change, and the answer comes back, "No problem, we're basically going to automate the way we've been doing things", then a red flag goes up. The basic position I take is that if it's not changing the organization, then it's having a marginal effect. I look for, on the line side, whether they have linked their notion of effective use of technology to their notion of restructuring the organization.

(Professor)

And perhaps this expert opinion was the most critical:

Very few managers really understand what technology is, or how it is used in their organizations.

(Researcher)

Another expert offered his perception of what makes a "highly aware manager":

He's the one who always sees I.T. rooted in a business context. Not separate and distinct from. A right-thinking senior manager ought to be thinking that an effective I.T. function is one which both figures out how to find the real high value, high payback uses of information technology, and does it, and, at the same time, is more selective and puts tighter filters down on the everyday run-of-the-mill request for technology.

(Consultant)

One expert evoked the days when Walter Wriston was the chairman of Citicorp:

One measure of effectiveness would be the extent to which I.T. has been made part of everyone's problem. I think that's one of the masterful things that Citibank and Wriston did back in the 1970's when they used the term electronic banking. What they meant was bankers who understand electronics. Wriston made electronics the job of the banker, not the other way around.

(Consultant)

Another expert characterizes senior managers as having three distinctly different attitudes and behavior:

The first type is the committed visionary who, given enough information, will support investments in new products until the end. If others are disposed to get something done, this manager will give them money and support and will stay with it all the way through. That's the committed visionary.

Then there's the naive visionary who hangs up when you really talk about change in the business. There's the "I'll take six pounds of American Hospital Supply" visionary for whom technology sounds good. "We should be modern. Let's have some." And they are not prepared for changes.

And then there are managers who are about the making of change. They didn't come to technology as a starting point. They may or may not understand technology well but they get practical and very tactical about getting it done. They can get visionary, but it's much more out of a business context. They're the best. They get the job done.

(Consultant)

Most experts expect a firm's executive committee to have developed a solid understanding of I.T.'s value and would ask, "Do the top executives have an explicit model of how they want to value I.T.?" Several others would want to know, "Do they have a vision of what will be required in their future I.T. infrastructure in order to support changes in business strategy?" Another indicator frequently mentioned is whether management is knowledgeable and informed about the new technological developments

that may represent important business opportunities in the future.

There is an implication that the CEO should be assessing someone else or something else. My belief is that it is the CEO's responsibility to see that an organization is using I.T. to its greatest advantage, as it would be for any asset. In this case, we happen to be talking about an asset that is changing the structure of industry and society around us. Change creates opportunity; hence, executives have to be the agents of change. I don't think it's someone else's responsibility; it's the CEO's responsibility.

(Consultant)

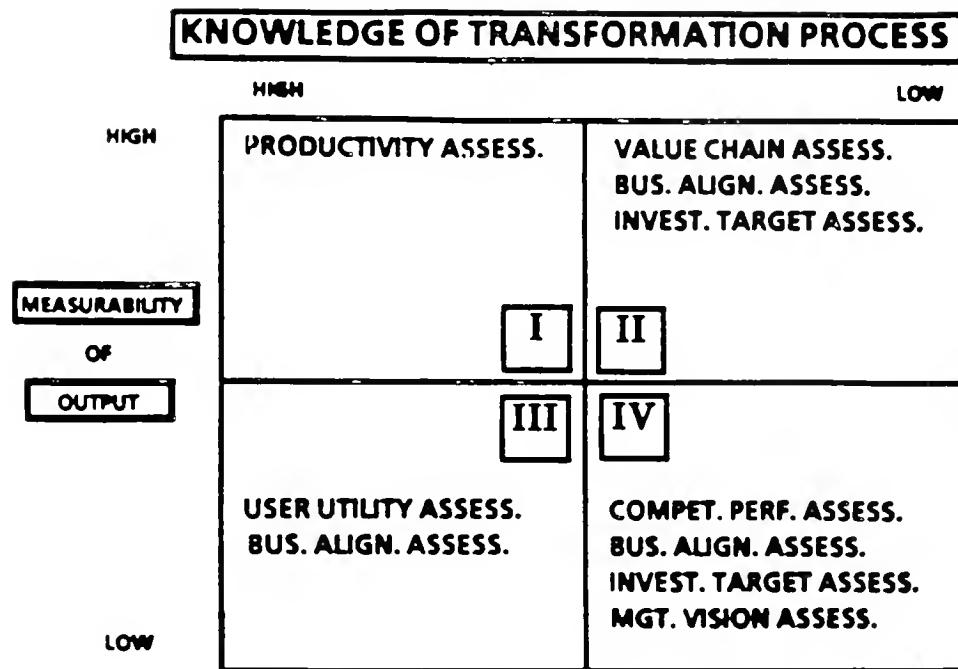
And so we have come full circle, from the uneasy CEO who confessed he was unable to assess I.T. performance to the expert who is critical of any CEO that has not picked up the gauntlet of strategic change and I.T. vision. What dialectic will reconcile these perspectives?

Conclusions

The problem may require a diagnosis that goes beyond the usual prescriptions of "improve communications between the technologist and executives," "develop a strategic I.T. plan," or "form an I.T. steering committee." Instead, what may be required is a radical rethinking of the process for formulating expectations and assessing performance.

In figure 5, each of the seven expert methods is analyzed in terms of its appropriateness for different conditions.

Figure 5. METHODS FOR ASSESSING I.T. PERFORMANCE



For executives with visions to automate their organizations, I.T. performance should be evaluated with productivity methods, and the emphasis should be on identifying indisputable and clear standards of performance. But, in situations where knowledge about the transformation process is imperfect and performance standards are not clear, such as those in which a vision to informate or transform the organization dominates organizational action, the use of multiple methods, such as competitive performance assessment, business alignment assessment, or management vision assessment, are more appropriate. We hypothesize that the control systems in many companies which were developed for an automating vision of I.T. do not provide the type of information executives need for determining whether they are fit for future action.

Top executives often expect performance to be evaluated with simple, quantifiable output measures because they are not knowledgeable or familiar with I.T. But instrumental tests of what is good performance can be extremely unstable because they are built on assumptions that past performance is a reliable means for predicting future performance.

We lack the metrics for assessing performance for visions to transform or informate organizations. An assessment for an informing vision relies primarily on behavioral variables: changes in patterns of information use, changes in roles and relationships between managers and employees, more comprehensive jobs, and changes in the fundamental premise of organizational authority.

Direct, expert and objective observation is required to make such judgements. One expert explained that these expectations require assessments that are more behaviorally focussed:

By interviewing everyone exposed to the technology, I have a much clearer and more objective picture of what is actually going on than any one individual does. The picture I would draw would be much more than what any one individual understood. The data are not only informing, but they become an artifact of organizational life.

People have limited cognitive maps not only of what they're doing with technology but of what they could be doing. This limited cognitive map is a consequence of having no time for reflecting and understanding technology. Many want assessment methods that are mass produceable. This is poor social science and reflects the worst of scientism. What I'm suggesting is that finding ways of pointing out inconsistencies in values and behavior is a valuable process for answering the question "Are we using I.T. effectively?"

(Researcher)

This may explain why many senior managers are dissatisfied with traditional measures of I.T. productivity. In the words of one expert:

Everything is cleaner to assess at the individual system level. But it is a question of "Is your I.T. infrastructure merely the summation of your applications?" My answer to that is no. There is more going on. There's this whole strategic piece. This asks, "How well positioned am I to solve tomorrow's problems with information technology?"

(Consultant)

If top management is explicit about their expectations for transforming the organization, this places demands on every business and functional manager to search actively for radical new product and service ideas, and to establish extremely ambitious performance targets. Such a vision fosters higher than normal levels of risk taking behavior. Developing and employing reliable measures and assessment procedures can be costly, and managers may avoid them because of these costs. But if managers refuse to reexamine whether, in fact, their control systems are appropriate for their expectations of information technology, they run the risk of being seduced by reports of performance based on measures and methods that are not suitable for answering the CEO's question, "Are we fit for future action?"

In closing, for managers who have concerns about how they assess I.T. performance, we would like to suggest several ideas. First, conduct an audit of all the various assessment approaches currently being used and then categorize them in terms of whether they rely on output, behavioral or attitudinal variables. With the control framework presented here, analyze the appropriateness of each for different conditions. Interview

key executives and users to find out how comfortable they are with these control systems. Then analyze what are your managers' visions for I.T. at different levels of the organization and across different business or functional units. Finally, reevaluate the appropriateness of your control systems in context of top management's expectations for information technology. All I.T. professionals evaluate what they are doing, but few have a rational structure for doing it. A firm's assessment process is a primary mechanism for learning and adaptation, and it should incorporate more than just one method.

NOTES

1. Schein, Edgar H. and Diane D. Wilson, "Executive Managements' Explicit Assumptions about Information Technology and Its Role in their Organizations", Unpublished report to the M.I.T. Management in the 1990s Steering Committee, Summer, 1987.
2. Zuboff, Shoshana, In the Age of the Smart Machine: The Future of Power and Work, Basic Books, New York, 1988, p. 9.
3. Personal conversation with Edgar Schein, December, 1987.
4. Zuboff, p. 9.
5. In Organizations in Action (1967), Thompson first defines efficiency, instrumental and social tests, and the conditions which determine their appropriateness. His ideas about social tests were derived from Festinger's theory of social comparison processes. Ouchi and Maguire (1975) applied these constructs to a study of 197 departments in 5 retail department stores and concluded that output measures are used most when least appropriate, under conditions of complexity, interdependence and lack of expertise, and that organizations should use two forms of control, one to serve institutional needs and one to serve subunit needs. Ouchi (1979) and Eisenhardt (1985) further developed Thompson's criteria for determining appropriate control systems.
6. Porter, Michael E. and Victor E. Millar, "How Information Gives You Competitive Advantage", Harvard Business Review, July-August, 1985. p. 151.
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